

## Modeling coupled heat and mass transfer during drying in tape casting with a simple ceramics-water system - DTU Orbit (08/11/2017)

### Modeling coupled heat and mass transfer during drying in tape casting with a simple ceramics-water system

In many industrial processes such as in tape casting for electronics or in the food industry, drying is one of the determining physical phenomena. In this study, the evaporation of water from a ceramic-water mixture is investigated with the purpose of understanding the drying rate in the drying process of thin sheets produced by the tape casting process. The rate of mass loss in the drying process is a key factor that often is of interest, as it affects the final properties of the tapes. The 1D heat conduction equation is solved numerically to obtain the temperature field in a ceramic sheet. The change in the concentration of the water content is then used as the driving force for diffusive mass transport of the water. Mass-averaged thermal properties are assumed for the ceramic-water mixture in the initial stage. As the water evaporates, the thermal properties of the solid ceramic become more dominant since the fraction of water approaches zero. The developed model is used to simulate a simple test for the drying process. The drying rate is simply calculated by examining the water content in each time step. It is found that the mass loss due to the evaporation is increasing close to linearly with the drying time corresponding to an almost constant drying rate. However, the rate starts to decrease after some time in the simulation. It is also shown that too extensive surface drying results in a slow diffusion rate from the bottom, which in turn reduces the drying rate in general and hence is not favorable from a process viewpoint.

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